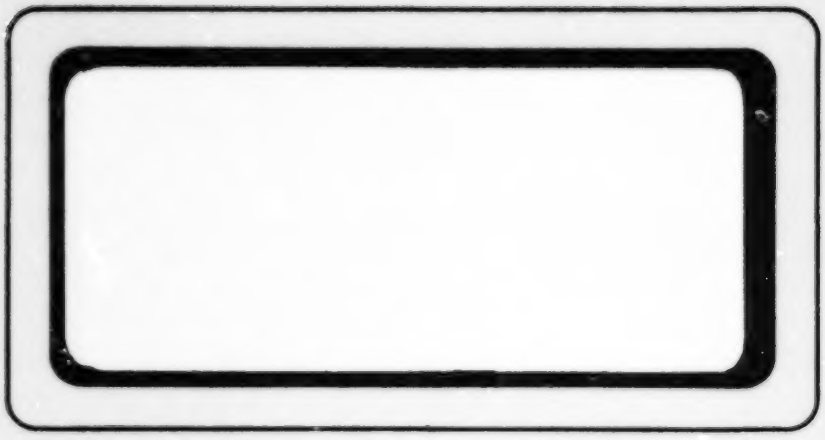

Province of
British Columbia

Ministry of
Environment

AQUATIC VEGETATION SURVEY OF THE MAJOR PARKS, GARDENS AND OTHER TOURIST ATTRACTIONS OF SOUTHERN VANCOUVER ISLAND AND THE LOWER FRASER VALLEY, 1982

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Tourism is a major industry on southern Vancouver Island and in the lower Fraser Valley. The climate is benign and conducive to the development of Parks and Gardens which cater to tourism. Most Parks and Gardens include creeks and ponds as part of their design and often feature aquatic plants. Aquatic weeds, such as milfoil, could cause substantial problems in these ponds. Many of these Park and Garden ponds have previously been visited as a part of the Ministry of Environment milfoil surveys but they have never been systematically surveyed and compared in one season and in one report. The surveys reported here (Table 1), took place in the autumn of 1982 and the results are compared with such previous data as existed. Some changes have occurred and eurasian water milfoil, as well as other native nuisance species, have been quick to exploit these new habitats (Table 2).

Each Park or Garden is discussed in a separate section below in alphabetical order. Topics covered include: the location of the site; an examination of the various ponds included; a listing of the aquatic plants found in 1982; a listing of previously known aquatic plants where applicable; a general description of the site. There may also be a discussion of the changes in vegetation, reasons for problems, predictions of future trends, and management recommendations, where these are applicable. Many of the lakes and ponds are included in the Aquatic Vegetation Data Base compiled by the Water Management Branch and as such will have a lake identification number assigned. This number is the key to extracting useful information about each body of water and is appended to the name of the lake or pond each time the pond is referenced. Due to the nature of these sites, specimens are rarely able to be collected and saved or examined closely for identification. Most common plants are identified to species "in situ", but, where closer examination is required for a positive identification, the specimens are identified only to the genus level.

Aquatic plants may be reported from a lake one year and absent the next. This does not necessarily mean they have permanently disappeared from the site. Conditions may simply not have been conducive to growth in any given year or competition may have been overwhelming at a critical part of

TABLE 1

THE PARKS AND GARDENS SURVEYED, LOCATIONS, AND SURVEY DATES

Beacon Hill Park	Victoria	September 10, 1982
Royal Roads Military College	Colwood	September 14, 1982
Bota Gardens	Richmond	September 20, 1982
The Park and Tilford Gardens	North Vancouver	September 20, 1982
The Minter Gardens	Chilliwack	September 20, 1982
U.B.C. Botanical Garden (including Nitobe Memorial Gardens)	Vancouver	September 21, 1982
Van Dusen Botanical Garden	Vancouver	September 21, 1982
Queen Elizabeth Park (including Bloedel Floral Conservatory)	Vancouver	September 21, 1982
Stanley Park (including Vancouver Public Aquarium)	Vancouver	September 22, 1982
Butchart Gardens	Brentwood	September 30, 1982
Crystal Garden	Victoria	November 9, 1982

TABLE 2

THE PRESENCE OF SPECIES OF MYRIOPHYLLUM IN THE PARKS AND GARDENS

Species	Parks and Gardens
Myriophyllum brasiliense (parrot feather)	Park and Tilford Gardens (597) The Bloedel Floral Conservatory Crystal Garden Vancouver Public Aquarium
Myriophyllum verticillatum	U.B.C. Botanical Gardens (680)
Myriophyllum heterophyllum	Queen Elizabeth Park Ponds (927), (410), (375)
Myriophyllum spicatum (eurasian water-milfoil)	Queen Elizabeth Park Ponds (375), (403) Var Dusen Botanical Garden (519) Minter Gardens (681) Bota Gardens (1013)

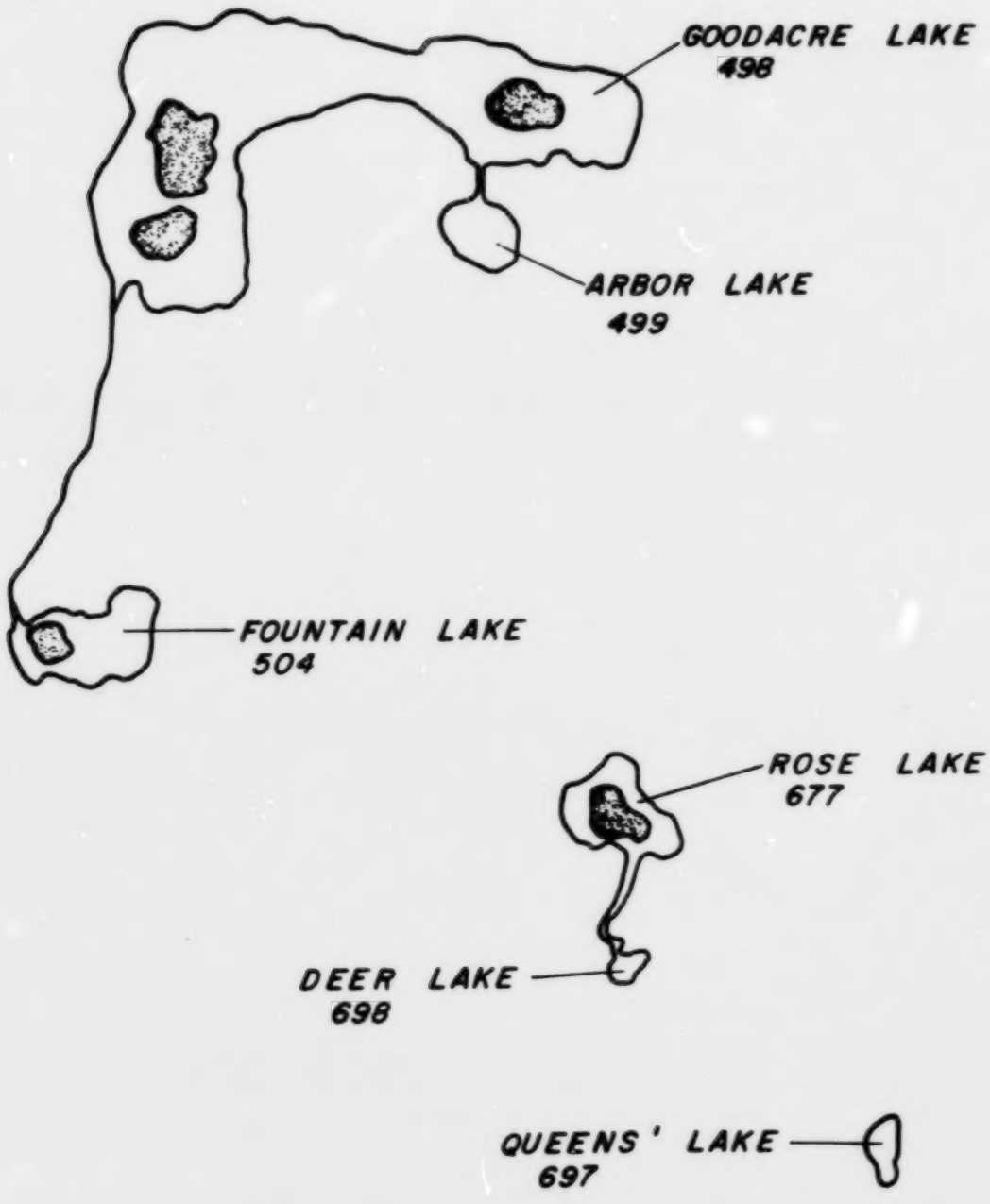
the season. It is also possible that the plant is or was present but was uncommon and overlooked or else the survey was carried out at the wrong time of the year while the plant was dormant. Only if a species does not reappear for several years in a row may it be presumed to have been eliminated. Many species have dormant periods when only roots or seeds may be present on the site and these may be difficult or impossible to find in this kind of survey.

BEACON HILL PARK

Beacon Hill Park is a well established public park in Victoria with 6 small, shallow ponds which are connected by a stream system. All the ponds are continuously and heavily grazed by waterfowl. Fountain Lake (504), contains cultivated water lilies (Nymphaea sp.) but the other ponds (Arbor Lake (499), Goodacre Lake (498), Rose Lake (677), Deer Lake (678), Queen's Lake (679), and a decorative fountain pond at the service building) have no plants.

In the same part of Victoria, two other ponds were checked. At the Archives building of the Provincial Museum there is a shallow, concrete pool in the native planting area which does not have any plants. There is a small pond on the grounds of the Empress Hotel which contains Lemna minor, Nymphaea sp., and Potamogeton sp.

BEACON HILL PARK



THE CRYSTAL GARDEN

This fairly new conservatory garden has a pool and stream system and a decorative fountain pond. Previous visits have only recorded Myriophyllum brasiliense in the fountain pond. This pond and the main pool now have carp in them. The main pond also has 2 pair of teal. The fountain pond no longer has the Myriophyllum brasiliense but has a blue-flowered horticultural variety of Nymphaea. The marginal emergent species Cyperus alternifolius has also been planted in these ponds.

BOTA GARDENS

This new garden has only been open to the public for 2 years. The first aquatic plant survey was made in the fall of 1981. Very noticeable changes have occurred in the aquatic vegetation during the intervening year as the habitat has become more mature. Several species have been deliberately introduced into this man-made pond system (cobble-bottomed and plastic-lined) but a number of very common species, indicative of eutrophic water in the lower Fraser Valley, are now also present. These may have been introduced by the waterfowl which frequent the ponds. A notable introduction which could prove to be a major nuisance is Myriophyllum spicatum.

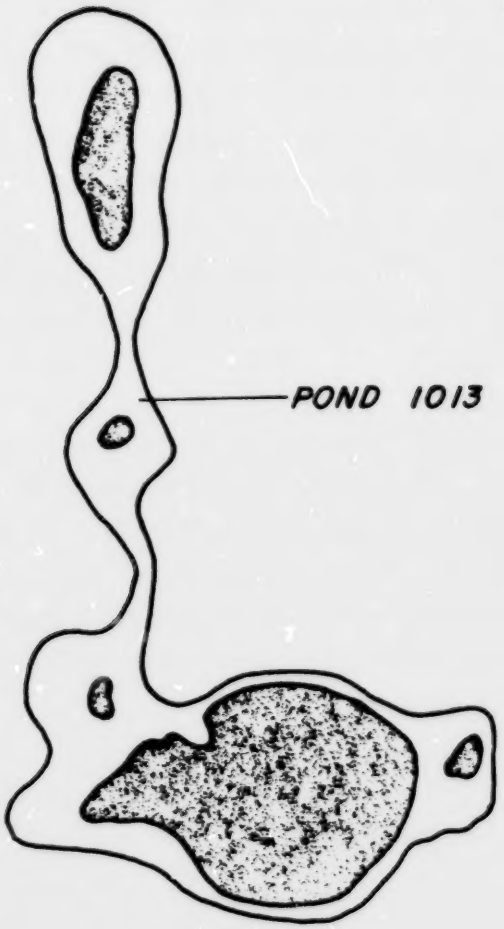
The pond is very shallow and becomes enriched from the surrounding gardens. Since the site is intensively maintained, the aquatic weed species which have entered the system may be kept under control, however, the potential for a serious eutrophic aquatic weed problem already exists.

SPECIES LIST: BOTA GARDENS POND (1013)

Species	Previous Records	1982
Callitriche heterophylla	✓	✓
Nymphaea sp. (2)	✓	✓
Sagittaria sp.	✓	✓
Caltha palustris		✓
Elodea canadensis*		✓
Typha latifolia		✓
Lemna minor*		✓
Potamogeton crispus*		✓
Potamogeton berchtoldii*		✓
Ranunculus asiaticus		✓
Myriophyllum spicatum*		✓

* These species are often pests in eutrophic waters

BOTA GARDENS



THE BUTCHART GARDENS

These world famous gardens were established in an abandoned quarry near Brentwood, almost 80 years ago. The gardens cover 14 ha and are divided into several different portions including Japanese gardens, formal (Italian) gardens, and sunken gardens, all containing ponds. The shallow concrete pond in the Italian gardens contains only Nymphaea sp. as does the adjacent Star pond. The fountain pool at the entrance to the Japanese garden does not have any plants. There are a series of interconnected ponds in the Japanese garden; all are concrete-lined and contain only Alisima plantago-aquatica and Nymphaea sp. It was not possible to get a close look at the pond in the fireworks viewing area but Typha latifolia could be seen around the shores. Similarly no close access to the shores of Ross Fountain pond was possible, but Nymphaea sp. were seen. There is a small pond at the garden entrance which has Nymphaea sp. as well as a pond beside the parking lot with Nymphaea sp. and Potamogeton pectinatus. There are two connected ponds in the Sunken Garden which have good access but are quite deep in the middle. Only Nymphaea sp. and Lemna minor were found. A combination of concrete-lined pools and intensive gardening will likely prevent aquatic weed problems here. Possible exceptions are the Fireworks and Ross Fountain natural lakes, and the parking lot pond; these all have natural bottoms and are not as intensively managed.

THE MINTER GARDENS

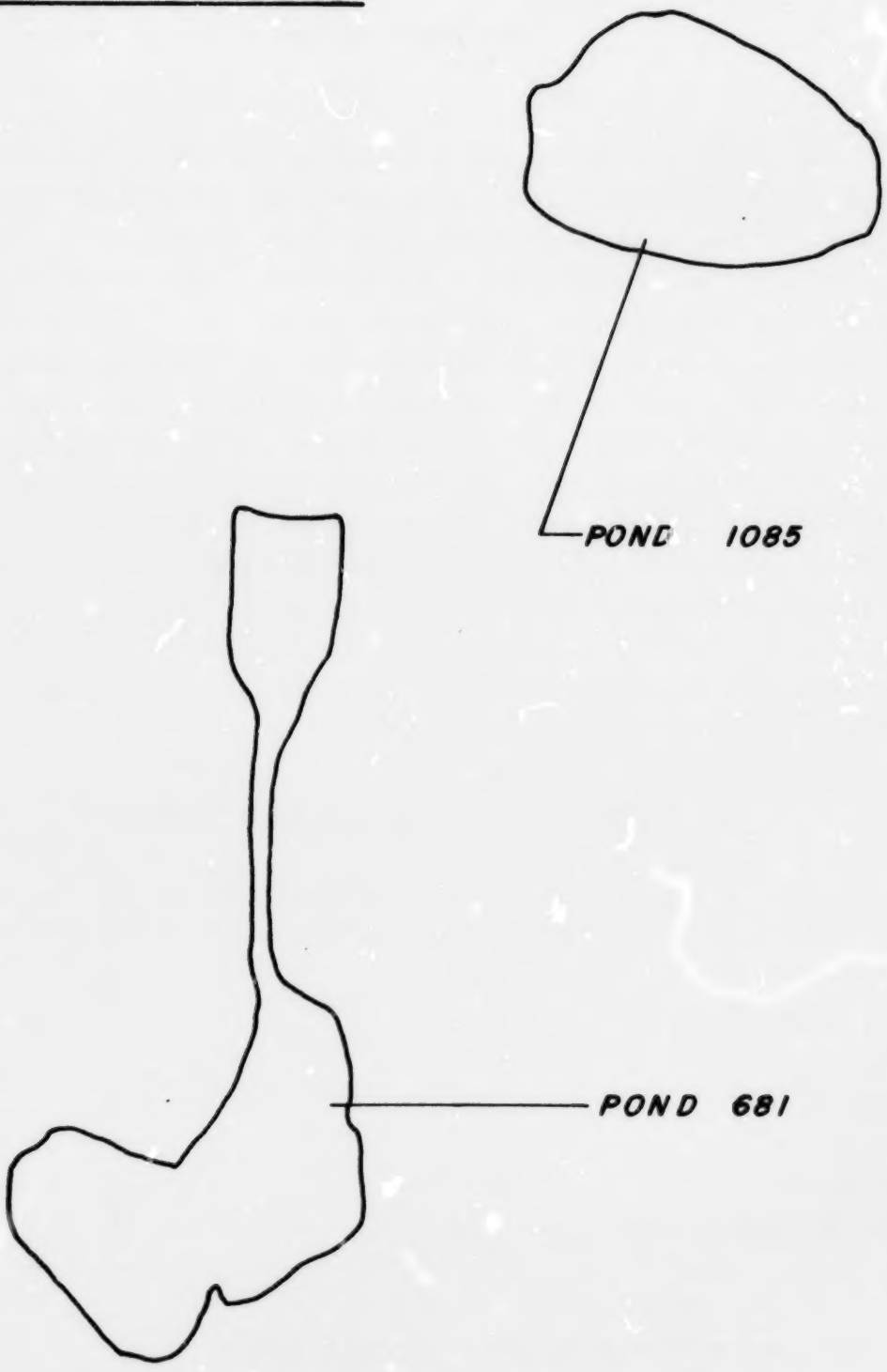
This relatively new garden was visited for the first time in 1982. Construction is still in progress in some areas but much of the garden is well established. A small stream runs down the hill into a pond with concrete walls on 3 sides. This flows by a wide channel into a larger, more natural shallow pond with gently sloping grassy banks (681). In a non-public area there is a small natural pond (1085) with different aquatic plants. While no waterfowl were seen on this visit, the garden is in an area frequented by ducks and host to a resident Canada goose population. Many nearby waterbodies have populations of Myriophyllum spicatum, which is apparently spread from pond to pond by the geese. Not too surprisingly the Minter Gardens Pond (681) already has M. spicatum established. A number of unidentified non-native species of aquatic plants are found in this pond. The water is clear and clean, runs down the creek constantly. It appears to be quite hard as evidenced by the extensive mats of marl-covered Chara. There is no sign of imminent eutrophication.

SPECIES LIST: MINTER GARDENS POND (681)

Species	Previous Records	1982
Scirpus sp.		✓
Iris pseudacorus		✓
Nymphaea sp.		✓
Sagittaria sp.		✓
Chara sp.		✓
Carex sp.		✓
Myriophyllum spicatum*		✓

* This species is often a pest in eutrophic waters

MINTER GARDENS



SPECIES LIST: MINTER GARDENS POND (1085)

Species	Previous Records	1982
Typha latifolia		✓
Rorippa nasturtium-aquaticum*		✓
Callitriche heterophylla		✓
Ricciocarpus natans*		✓

* These species are often pests in eutrophic waters

THE PARK AND TILFORD GARDENS

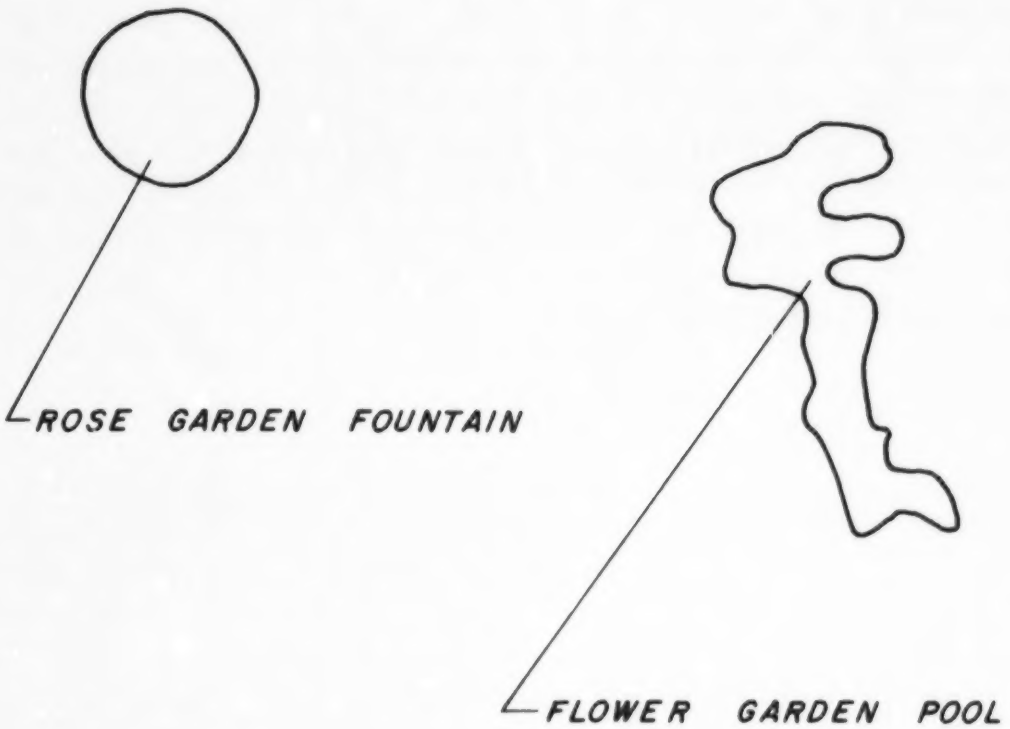
This garden is on the grounds of the Park and Tilford Distillery in North Vancouver and is maintained by the company for public use. The ponds are all artificial and concrete-lined. Most plants have been deliberately introduced and are maintained by a full-time staff of gardeners.

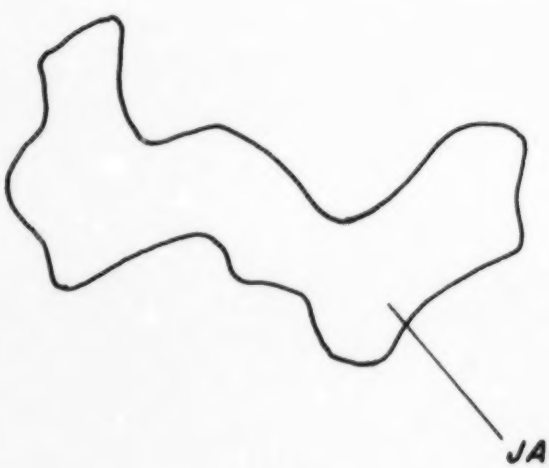
The fountain pool is very shallow and tiled; it has no plants. The flower garden pool and creek has some Menyanthes trifoliata growing in pots beneath the Gunnera but is not otherwise planted. The Japanese garden pond (597) is the main aquatic garden. It is concrete, has walkways around most of the margin and a bridge over the middle. In addition to the species recorded in the table below, there are a number of introduced non-native aquatic plants in this pond which were not identified. No waterfowl have ever been seen here in several years of regular observations. The garden is in a heavy industry zone and suffers badly from deposition of a blackish material on the plants.

SPECIES LIST: JAPANESE GARDEN POND (597)

Species	Previous Records	1982
Callitriche sp.	✓	✓
Nymphaea sp.	✓	✓
Typha latifolia	✓	✓
Menyanthes trifoliata	✓	✓
Sagittaria sp.	✓	✓
Scirpus sp.	✓	✓
Equisetum sp.	✓	✓
Alisma sp.	✓	✓
Myriophyllum brasiliense	✓	✓

PARK AND TILFORD GARDENS





The presence of Myriophyllum brasiliense in this outdoor pond is of special interest. This species is a major pest in tropical and subtropical areas yet has been able to survive several winters with sub-freezing weather in North Vancouver. M. brasiliense often grows marginally as well as in the water and was seen one winter covered with ice as it sprawled alongside the waterfall. Thus M. brasiliense has shown that it can grow in temperate climates but we do not yet have any data on its ability to compete with native species outside cultivation.

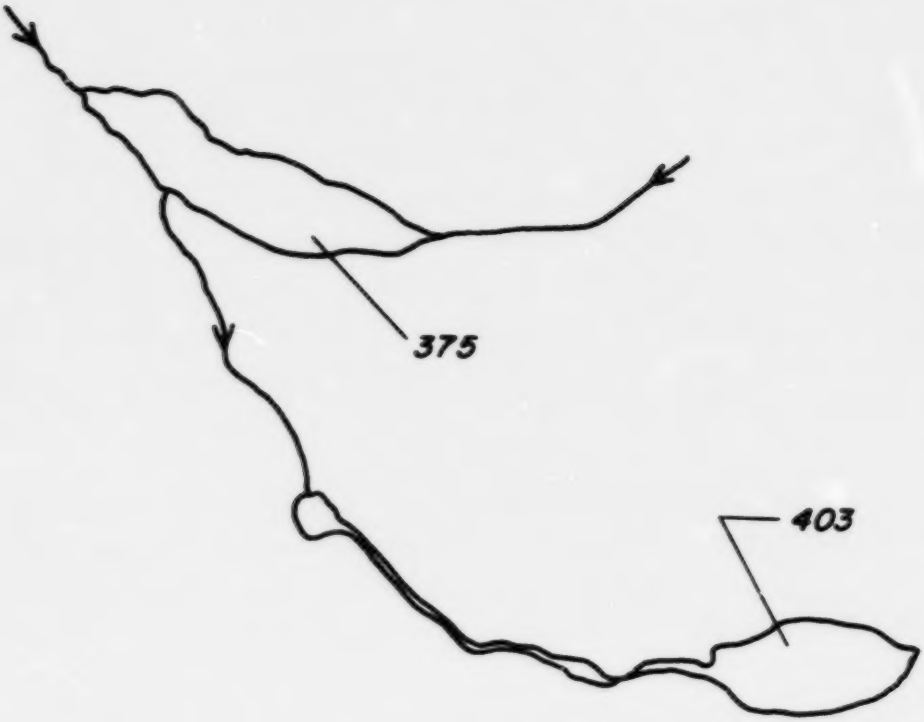
QUEEN ELIZABETH PARK

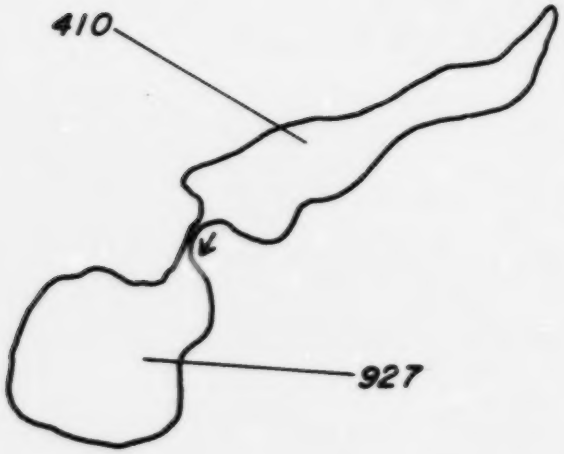
This park is on a hill in South Vancouver and has the Bloedel Floral Conservatory on the top. There is an old quarry near the top which has been landscaped and has a stream and several ponds. These upper ponds are shallow, small and clean and contain only Nymphaea sp. and Callitriche heterophylla. The main pond inside the Conservatory has large carp, Nymphaea sp., Myriophyllum brasiliense, Eichornia crassipes and Pistia stratiotes. These last three plants are among the worst of the subtropical aquatic weeds.

Near the base of the hill there are 4 ponds in two connected pairs. Pond (410), the upper of its pair, has Nymphaea sp., Callitriche heterophylla and Myriophyllum heterophyllum. The lower pond (927), fed by a creek from pond (410) has the same 3 species plus Elodea canadensis.

Below the golf course there is another pair of ponds. The upper pond (375) contains many species of aquatic plants and has been surveyed and mapped annually for several years to document the ongoing competition between Myriophyllum spicatum and M. heterophyllum. The lower pond (403) has a little Alisma plantago-aquatica, Lemna minor and Myosotis laxa, but is 99% covered by M. spicatum.

QUEEN ELIZABETH PARK





SPECIES LIST: POND(403), QUEEN ELIZABETH PARK

Species	Previous Records	1982
Myriophyllum spicatum*	✓	✓
Alisma plantago-aquatica	✓	✓
Lemna minor*	✓	✓
Myosotis laxa		✓
Elodea canadensis*	✓	
Callitriche heterophylla	✓	
Utricularia minor	✓	
Sparganium emersum	✓	
Myriophyllum heterophyllum*	✓	
Potamogeton berchtoldii*	✓	
Potamogeton crispus*	✓	

* These species are often pests in eutrophic waters

SPECIES LIST: POND (375), QUEEN ELIZABETH PARK

Species	Previous Records	1982
Myriophyllum heterophyllum*	✓	✓
Myriophyllum spicatum*	✓	✓
Callitriche heterophylla	✓	✓
Lemna minor*	✓	✓
Nymphaea sp.	✓	✓
Alisma plantago-aquatica	✓	✓
Potamogeton crispus*	✓	✓
Myosotis laxa		✓
Elodea canadensis*	✓	
Callitriche stagnalis	✓	
Sparganium emersum	✓	
Potamogeton foliosus*	✓	

* These species are often pests in eutrophic waters

SPECIES LIST: POND (410), QUEEN ELIZABETH PARK

Species	Previous Records	1982
Elodea canadensis*	✓	
Callitriche stagnalis	✓	
Callitriche heterophylla	✓	✓
Myriophyllum heterophyllum*	✓	✓
Nymphaea sp.	✓	✓

* These species are often pests in eutrophic waters

SPECIES LIST: POND (927), QUEEN ELIZABETH PARK

Species	Previous Records	1982
Hypericum anagalloides	✓	
Potamogeton crispus*	✓	
Nymphaea sp.	✓	✓
Elodea canadensis*	✓	✓
Myriophyllum heterophyllum*	✓	✓
Callitriche heterophylla	✓	✓

* These species are often pests in eutrophic waters

ROYAL ROADS MILITARY COLLEGE

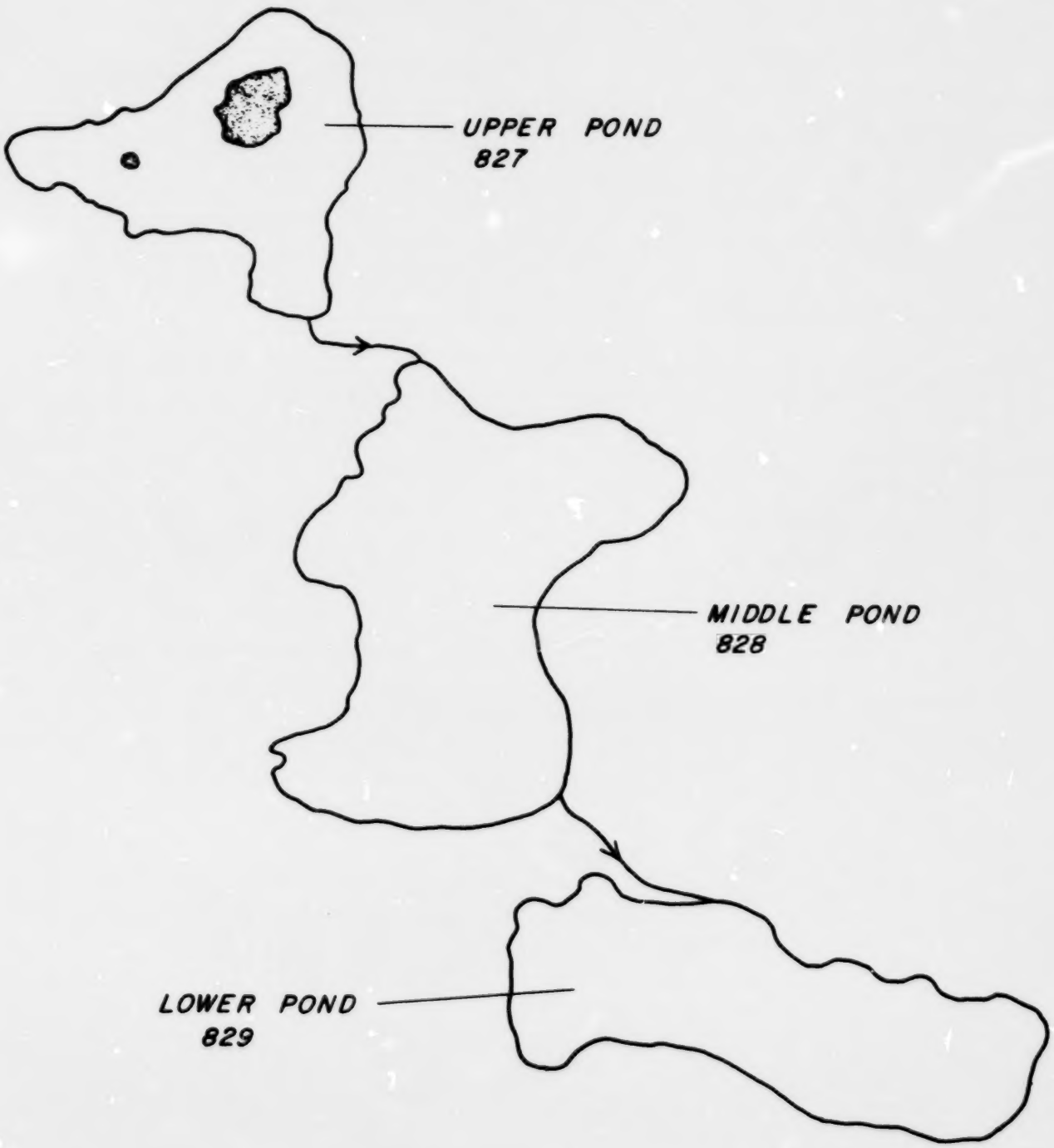
This site is on the shore of the Esquimalt Lagoon on the outskirts of Victoria. Formerly Hatley Park, a private castle and garden, it is now a Military College and research area. Much of the pond and stream system and gardens has been maintained and is open to the public. A stream drains through the grounds and has been directed through 3 main ponds, called, in order, upper lake (827), middle lake (828), and lower lake (829). The upper lake (827) is quite well developed and has rock walls, paths and a Japanese theme complete with bridge and teahouse. The middle (828) and lower (829) lakes are relatively undeveloped with limited access and natural shorelines. It appears that only limited maintenance and upkeep occurs. The lakes are filling in and experience algal blooms and eutrophication. Waterfowl were observed feeding in these ponds.

SPECIES LIST: UPPER LALKE (827)

Species	Previous Records	1982
Nitella sp.	✓	
Callitriche sp.	✓	
Sparganium sp.	✓	
Potamogeton natans	✓	✓
*Lemna minor**		✓

* This species is often a pest in eutrophic waters

ROYAL ROADS MILITARY COLLEGE



SPECIES LIST: MIDDLE LAKE (828)

Species	Previous Records	1982
Sparganium emersum	✓	
Callitriche sp.	✓	
Ceratophyllum demersum*	✓	✓
Oenanthe sarmentosa	✓	✓
Mysotis laxa	✓	✓
Alisma plantago-aquatica	✓	✓
Lemna minor*	✓	✓
Spirodela polyrhiza*	✓	✓
Typha latifolia	✓	✓
Rorippa nasturtium-aquaticum*		✓
Iris pseudacorus		✓
Ranunculus aquatilis*		✓
Potamogeton foliosus*		✓
Potamogeton natans		✓

* These species are often pests in eutrophic waters

SPECIES LIST: LOWER LAKE (829)

Species	Previous Records	1982
Myosotis sp.	✓	
Sparganium emersum	✓	
*Ranunculus aquatilis**	✓	✓
*Ceratophyllum demersum**	✓	✓
*Lemna minor**	✓	✓
*Spirodela polyrhiza**	✓	✓
Potamogeton natans	✓	✓
*Potamogeton foliosus**		✓
*Rorippa nasturtium-aquaticum**		✓
Callitriche sp.		✓

* These species are often pests in eutrophic waters

STANLEY PARK

Stanley Park, established over 90 years ago, is popular and heavily used by citizens of and visitors to Vancouver. Beaver Lake (129) is a shallow bog lake with very intensive waterfowl use and appears to be in the later stages of filling in. A very noticeable increase is evident, since the last visit several years ago, in the percentage of the surface covered by Nymphaea sp. These water lilies presently cover about 80% of the surface. Menyanthes trifoliata is also very abundant. The other species are all infrequent and/or marginal emergents. All the small, fleshy, submerged species have been eaten. Old herbarium records for this lake indicate greater historical diversity which has apparently succumbed to the heavy waterfowl use.

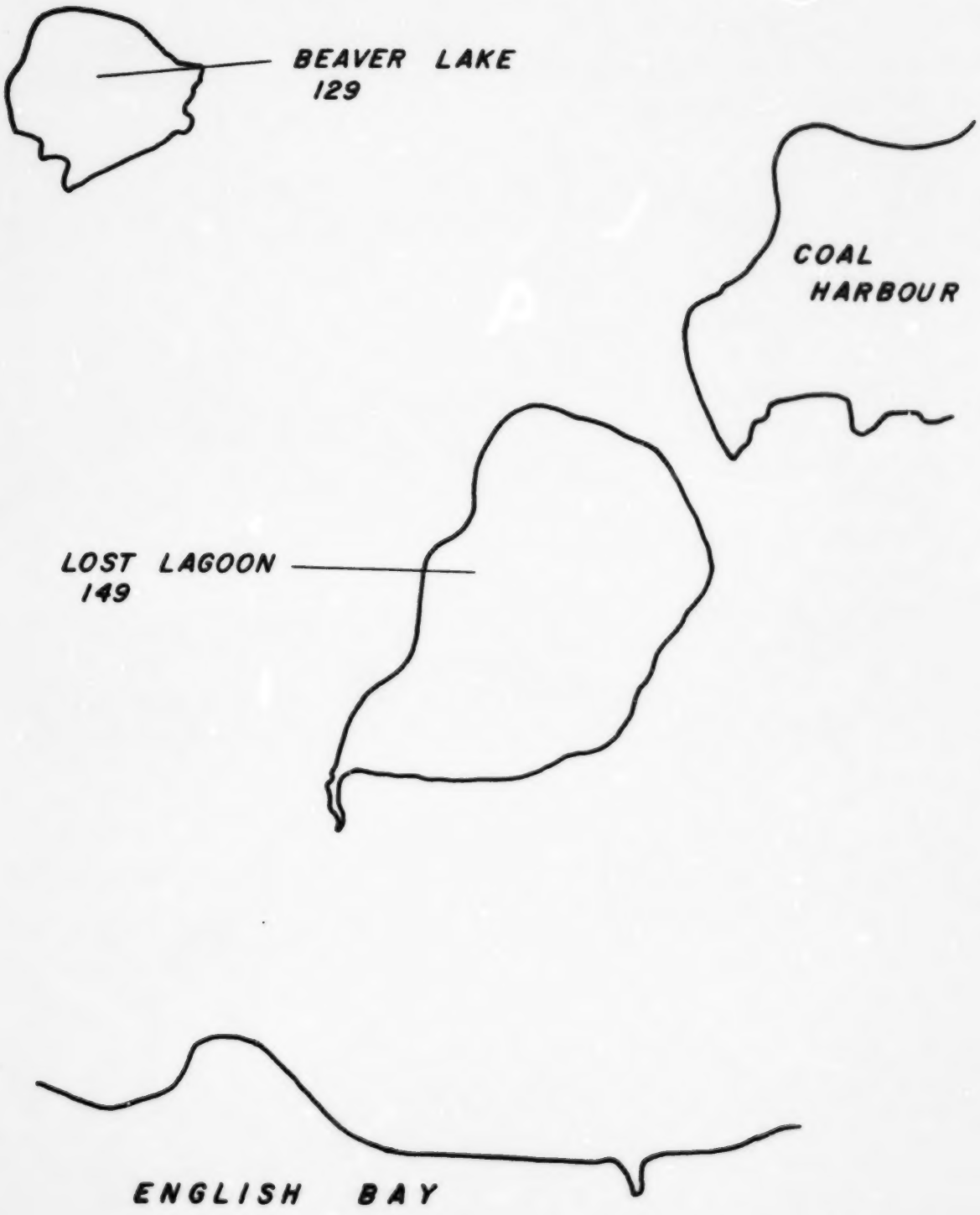
Lost Lagoon (149) was apparently once open to the sea at one end and is not comparable to Beaver Lake. It also suffers from very heavy waterfowl pressure and contains only 3 large and robust species of emergent aquatic plants, Iris pseudacorus, Typha latifolia and Scirpus lacustris. Water clarity is very poor. Although both these lakes could be considered eutrophic from a nutrient standpoint, continuous heavy grazing pressure by waterfowl will prevent aquatic plants becoming established. Previous records for Lost Lagoon indicate that Ruppia maritima, Oenanthe sarmentosa and Montia fontana, at least, were once found here but are now eliminated.

All the other shallow duck ponds in the zoo area of the park are barren due to heavy grazing. In the freshwater display tanks of the aquarium, many species of aquatic plants are used for background, shelter and aesthetics. Many of these are tropical or subtropical species and pose no problems here in B.C. On a previous visit, Myriophyllum spicatum was being used extensively in these freshwater tanks. This practice has now been discontinued. The aquatic plants identified in 1982 included Myriophyllum brasiliense, Elodea densa, Vallisneria americana and Cabomba sp.

SPECIES LIST: BEAVER LAKE (129), STANLEY PARK

Species	Previous Records	1982
Myriophyllum hippuroides	✓	
Lemna minor	✓	
Montia fontana	✓	
Veronica scutellata	✓	
Oenanthe sarmentosa	✓	
Brasenia schreberi	✓	
Ranunculus flammula	✓	
Utricularia minor	✓	
Utricularia gibba	✓	
Dulichium arundinaceum	✓	✓
Nuphar polysepalum	✓	✓
Nymphaea sp.	✓	✓
Menyanthes trifoliata	✓	✓
Iris pseudacorus	✓	✓
Potentilla palustris	✓	✓
Typha latifolia	✓	✓

STANLEY PARK



THE U.B.C. BOTANICAL GARDEN

The U.B.C. Botanical Garden is formed of many different teaching and research plots distributed throughout the campus. The two sites looked at in 1982 which have open bodies of water were the Nitobe Memorial Garden and the main gardens; the latter are presently under development to the south and east of the new stadium at 16th Ave. and S.W. Marine Drive.

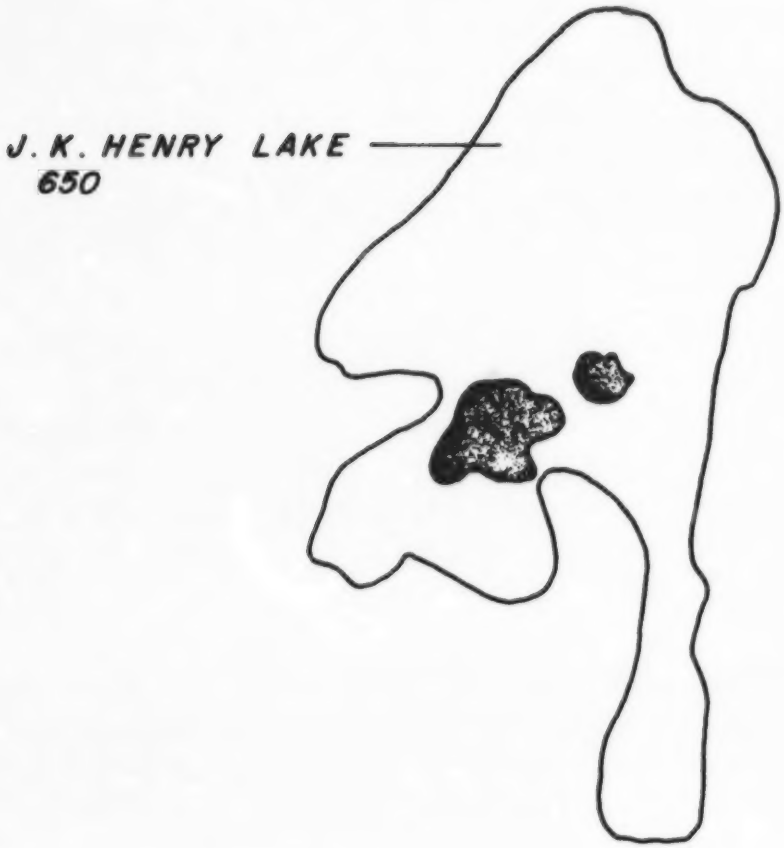
The Japanes Nitobe Memorial Garden was opened in 1960 and contains an artificial, concrete-lined pond (682). Nymphaea sp., Callitriche heterophylla and Iris pseudacorus were found here. This pond has many large herbivorous carp. A small pond in the Alpine portion of the main garden contains Lirtope minor, Typha minima and Fauria crista-galli. There is a shallow boggy pond called J.K. Henry Lake (680) which has quite an extensive list of native species including one rare occurrence in B.C. of Azolla filiculoides, an aquatic fern.

This was the first time that this garden, much of which is still under development, had been surveyed for aquatic plants. Many changes to the pond and stream systems are planned and the species composition will doubtless change as development proceeds. No problems are seen here at this time.

SPECIES LIST: NITOBE GARDENS POOL (682)

Species	Previous Records	1982
Nymphaea sp.		✓
Callitriche heterophylla		✓
Iris pseudacorus		✓

U.B.C. BOTANICAL GARDENS



SPECIES LIST: J.K. HENRY LAKE (680), U.B.C. BOTANICAL GARDENS

Species	Previous Records	1982
Scirpus lacustris		✓
Menyanthes trifoliata		✓
Potamogeton natans		✓
Equisetum fluviatile		✓
Myriophyllum verticillatum		✓
Azolla filiculoides		✓
Eleocharis palustris		✓
Typha latifolia		✓
Callitriche heterophylla		✓
Iris pseudacorus		✓
Utricularia minor		✓

THE VAN DUSEN BOTANICAL GARDEN

This garden opened officially in 1975 on the site of the old Shaughnessy Golf Course in Vancouver. Development of some areas is still going on. It is a large, 22.5 ha garden with an extensive interconnected system of ponds and creeks considered here as one site (519). This site has been checked several times before and has had a problem with Myriophyllum spicatum. Although none was observed in September 1982, it may be more evident in the spring. The several ponds and arms have been given an identification number and the table indicates in which ponds or arms the species was found.

SPECIES LIST: VAN DUSEN BOTANICAL GARDEN POND (519)

Species	Sites in 1982							Previous Records	1982
	1	2	3	4	5	6	7		
Alisma plantago-aquatica					✓	✓	✓	✓	✓
Callitriche heterophylla			✓	✓	✓	✓		✓	✓
Myosotis laxa		✓	✓			✓	✓	✓	✓
Nymphaea sp. (4)	✓	✓	✓		✓		✓	✓	✓
Nelumbo sp.		✓						✓	✓
Potamogeton crispus*	✓	✓	✓	✓	✓		✓	✓	✓
Menyanthes trifoliata		✓						✓	✓
Typha latifolia	✓	✓	✓		✓		✓	✓	✓
Sagittaria latifolia	✓	✓						✓	✓
Scirpus lacustris	✓		✓					✓	✓
Polygonum amphibium	✓							✓	✓
Eleocharis palustris			✓					✓	✓
Lemna minor*			✓	✓				✓	✓
Potamogeton foliosus*				✓				✓	✓
Elodea canadensis*					✓			✓	✓
Potamogeton praelongus								✓	
Myriophyllum spicatum*								✓	
Ranunculus flammula								✓	
Polygonum hydropiper								✓	
Veronica americana								✓	
Mimulus guttatus								✓	
Montia fontana								✓	
Eleocharis acicularis								✓	
Iris pseudacorus	✓	✓							✓
Ceratophyllum demersum*		✓							✓
Potentilla palustris		✓							✓
Acorus calamus	✓								✓
Nitella sp.	✓								✓
Scirpus subterminalis					✓		✓		✓

* These species are often pests in eutrophic waters

VAN DUSEN BOTANICAL GARDEN